Fish Entrainment Compliance at Cooling Water Intakes for Hydroelectric Facilities

Presented by Valerie Oster, Sydney Gonsalves, and Larissa Rohrbach

NW Hydropower Association Fall Regional Workshop

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Introduction

• Anchor QEA: We strive to be a growing company that is our clients' first choice for solving their most challenging problems and our employees' first choice as a company where they want to work.
Clean Water Act 316(b) Introduction

- Final Rule effective October 2014
- Triggered by renewal or new application for CWA 402 NPDES permit
- Applies to facilities operating Cooling Water Intake Structures (CWIS) with certain conditions

Map of facilities subject to 316(b)
Source: EPA 2014
Clean Water Act 316(b) Introduction (cont.)

- CWIS applicability conditions include
  - Utilities, generally “power-generating facilities”
  - Industries
  - CWIS designed to withdraw more than 2 million gallons of water per day; at least 25% is used for cooling purposes
  - Existing or new structures
CWA 316(b) Compliance Requirements

- Applicants must demonstrate use of best technology available (BTA) for minimizing adverse impacts of impingement and entrainment of fish and/or shellfish in the CWIS
  - Regulations include different standards for existing and new structures, with additional standards for CWIS exceeding withdrawals of 125 million gallons per day
  - Standards include a range of technologies and may include completing additional studies
  - Entrainment compliance includes site-specific considerations
CWA 316(b) Agency Involvement

• EPA promulgated CWA 316(b) as part of NPDES rules
• NMFS and USFWS developed ESA Biological Opinion for 316(b) rule, review NPDES permits
• NPDES mostly administered by state agencies, which oversee 316(b) compliance
CWA 316(b) Facility Implementation Timeline

• Operator will complete studies and evaluations consistent with CWA 316(b) guidance
• Final draft NPDES permit includes site-specific entrainment BTA standards
• Facility selects option for BTA impingement compliance
• NPDES permit with CWA 316(b) compliance requirements issued by the permitting agency
• Facility implements the standards and conducts monitoring and reporting
• Additional studies may occur based on results
CWA 316(b) – Uncertainty Remains

• Uncertainty remains
  – The proposed Rule from 2011 clearly excluded hydropower, but the final Rule is silent?
    • Recent state-based NPDES general permit drafts have raised the issue of CWA 316(b) compliance for hydro facilities in Massachusetts, New Hampshire, Idaho
  – What does compliance with BTA requirement for impingement or entrainment standards look like at different facilities? For different species?
Evaluating the Impact of Fish Entrainment and Impingement
Experience at Cooling Water Intake Sites

Larval Eulachon

Juvenile Lamprey

Chinook Fry
Specific Challenges Encountered

- Complexity of hands-on studies
- Existing structures that pre-date guidance and regulation
- Screening guidelines
  - Focus on endangered species (e.g., salmon and steelhead)
  - Application to unique scenarios at different structures
Approaches: Direct Study

- Fish survey
  - Occurrence
  - Exposure
- Experimentation
  - Release-recapture
- Quantifying impacts
  - Entrainment rate
  - Expansion to population-level impact

\[
\% \text{ Entrainment} = \frac{TSE}{R}
\]

\(TSE\) = total seasonal entrainment

\(R\) = modeled total number of pre-smolts given estimated egg escapement (from Harnish et al. 2014)
Approaches:
Risk Assessment

- Logical organization of existing information
- Qualitative or semi-quantitative
- Leverage existing information

Adapted from Normandeau and ASA
Fish Community Interactions with an Intake

- Fish exposure to the intake as a stepwise process
- Combined knowledge of river conditions and fish characteristics that increase vulnerability
Fish Community Interactions with an Intake (cont.)

Data source: Grant PUD
Fish Community Interactions with an Intake (cont.)

Modeled velocity and depth reveals microhabitats

Data Source: Perkins, Richmond, and Niehus, PNNL Hydrology Group, 2018
Screen Hydraulics and Performance

- Fish movement around the structure as a stepwise process

Image: Alden Research Laboratory
Combined Risk Assessment: Biological and Physical Factors Influence Risk

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<tr>
<th>Common Name</th>
<th>Life Stage</th>
<th>Jan</th>
<th>Feb</th>
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Overall Conclusions – CWA 316(b)

• NPDES permit processes require addressing more than just water quality criteria
• The application of these regulations in hydropower is an emerging and evolving issue
• Impact assessment to demonstrate compliance can range from qualitative approaches to rigorously quantitative using specialized statistical approaches
• Hydroprojects collect extensive, high-quality data that can be leveraged to estimate risk
Questions/Discussion